

Prediction of human adaptation and performance in underwater environments

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Abstract

Background: Environmental stressors require the professional diver to undergo a complex process of psychophysiological adaptation in order to overcome the demands of an extreme environment and carry out effective and efficient work under water. The influence of cognitive and personality traits in predicting underwater performance and adaptation has been a common concern for diving psychology, and definitive conclusions have not been reached. **Method:** In this ex post facto study, psychological and academic data were analyzed from a large sample of personnel participating in scuba diving courses carried out in the Spanish Navy Diving Center. In order to verify the relevance of individual differences in adaptation to a hostile environment, we evaluated the predictive validity of general mental ability and personality traits with regression techniques. **Results:** The data indicated the existence of psychological variables that can predict the performance ($R^2 = .30, p < .001$) and adaptation ($R_N^2 = .51, p < .001$) of divers in underwater environment. **Conclusions:** These findings support the hypothesis that individual differences are related to the probability of successful adaptation and effective performance in professional diving. These results also verify that dispositional traits play a decisive role in diving training and are significant factors in divers' psychological fitness.

Keywords: Individual differences, predictive validity, military personnel, diving psychology.

Resumen

Predicción de la adaptación y rendimiento humanos en el medio subacuático. Antecedentes: los estresores ambientales exigen al buceador profesional un complejo proceso de adaptación psicofisiológica para superar las demandas de un medio extremo y desarrollar trabajos subacuáticos efectivos. La influencia de los rasgos cognitivos y de personalidad para predecir la adaptación y el rendimiento ha constituido una preocupación constante en Psicología del buceo, aunque no se han alcanzado conclusiones definitivas. **Método:** en este estudio ex post facto se analizaron datos psicológicos y académicos de personal que realiza cursos de buceo en el Centro de Buceo de la Armada Española. Con el fin de verificar la relevancia de las diferencias individuales en la adaptación a un ambiente hostil, hemos evaluado la validez predictiva de la inteligencia y personalidad mediante técnicas de regresión. **Resultados:** los datos obtenidos indicaron la existencia de variables psicológicas útiles para predecir el rendimiento ($R^2 = .30, p < .001$) y la adaptación ($R_N^2 = .51, p < .001$) en el medio subacuático. **Conclusiones:** estos hallazgos confirman la hipótesis de que las diferencias individuales guardan relación con la probabilidad de obtener una satisfactoria adaptación y rendimiento efectivo en buceo profesional, tienen un papel decisivo en la formación de buceadores y son factores significativos en su aptitud psicológica.

Palabras clave: diferencias individuales, validez predictiva, personal militar, Psicología del buceo.

The underwater environment has a significant impact on human behavior and performance due to the generalized stress factors of different kinds (Selye, 1964, 1974). These stressors can be structural (exposure to high pressures and aquatic environment), environmental (variations of temperature, thermal conductivity and visibility), physiological (toxicity of breathing gases) and psychological (changes in anxiety and sensory stimulation). As a result, divers must undergo a significant process of psychophysiological adaptation (Lazarus, 1966, 1991; Lazarus & Folkman, 1984). They must modify their circulatory and respiratory physiology, as well as adapt to modifications in the

sense organs, to a progressive reduction of human performance, and to increased emotional arousal, in order to remain under water, preserve their health, and carry out useful work in this extreme environment (Bachrach & Egstrom, 1987; U.S. Navy, 2008).

In the field of scientific and operational diving, the typical peculiarities of this professional activity are emphasized because of the fact that it is practiced in an extreme setting. There is a tendency to focus on the specific physical, medical and psychological characteristics required for the divers to be able to adapt to unusual conditions and overcome the major underwater environment stressors. The psychological approach can contribute to safety by reducing the risk of diving accidents. This approach may also promote the welfare of divers by facilitating their adaptive potential and improving their performance. Consequently, this paper analyzes the relationship of the dispositional traits of divers with their performance and adaptation in the undersea environment.

This study is based on psychological models of intelligence (Cattell-Horn-Carroll model) and personality traits (Five Factor model) and individual differences in anxiety as significant variables in adaptation to the demands of diving (Carroll, 1993; Costa & McCrae, 1992; Horn & McArdie, 2007; John, Nauman, & Soto, 2008). These variables form the basis of a line of research in industrial and military settings as a result of their capacity to predict performance and behavior in the most varied positions and organizations (Barrick & Mount, 2005; Barrick, Mount, & Judge, 2001; Mount & Barrick, 1995; Ones, Visweswaran, & Dilchert, 2005; Ree, Earles, & Teachout, 1994; Salgado, 2003; Salgado et al., 2003; Schmidt & Hunter, 2004), in accordance with the general model of performance. On the one hand, intelligence is the ability to solve abstract problems and to learn. It is also considered as the set of necessary skills for performing satisfactorily in various professional fields or as adaptability to the environment and to relatively new situations. Although historically, this conclusion has not been unanimous, meta-analysis has found empirical evidence regarding the predictive validity of the *g*-factor tests on training and performance in the workplace and in different circumstances of everyday life (Gottfredson, 1997; Ones et al., 2005). In this sense, capacity for learning and problem solving, correct decision making, accurate judgment and the ability to adapt to new environments and situations are theoretically important facets of diving. On the other hand, the role of personality variables has not been completely clarified to date, although it has always been believed that behavior and performance are influenced by dispositional traits (Revelle, Wilt, & Condon, 2011). Meta-analytic studies have removed the doubt on this issue. Thus, nowadays, it is accepted that personality in the workplace matters and that the dimensions of responsibility and emotional stability are two general criteria for personnel selection and also valid predictors in almost all occupations and measurements of performance (Barrick & Mount, 2005; Barrick et al., 2001). Therefore, the diver must be able to perform effectively in stressful and emergency conditions, coping with ease, confidence, security and emotional stability.

In addition, underwater performance and adaptation are linked to the category of adaptive performance and to the component of task performance in the general model proposed by Campbell and others (Campbell, McCloy, Oppler, & Sager, 1993; Pulakos, Arad, Donovan, & Plamondon, 2000). These criteria are related to the components of task proficiency and the dimensions of handling environmental emergencies and work stress, solving underwater problems, and learning diving tasks and technologies. Finally, the diver must have enough emotional control to respond appropriately to the environmental circumstances and the psychophysiological conditions of immersion (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007; Staal, 2004). The relationship between activation, anxiety, stress and performance is particularly important for adaptation in the diving field, where the errors associated with the complex environmental demands can cause a high level of risk and significant physiological, emotional, cognitive, behavioral and social costs (Bachrach & Egstrom, 1987; Baddeley & Idzikowski, 1985; Morgan, Raglin, & O'Connor, 2004). Consequently, it may be interesting to empirically analyze the importance of intellectual capacity and personality traits by studying their relationship with performance during the training of divers and with adaptation to the demands of diving practice.

Although early studies in the underwater environment analyzed the influence of differential skills, cognitive assessment for

prediction of diving performance and adaptation focused on general mental ability (Berghage, 1972; Wise, 1963). Personality traits were also related to training criteria in diving, with a personality profile being defined that was considered to be functional in the underwater environment, but which had limited practical relevance (Biersner, 1984; Biersner & Larocco, 1987). In the initial works on the validity of psychological tests in Spanish and Australian divers, it was found that intellectual ability and personality traits were significantly correlated to the results obtained in diving courses with self-contained underwater breathing apparatus (SCUBA) (Colodro, 1994; Edmonds, 1972). The physical variables used in studies with U.S. divers also contributed to knowledge in this area (Hogan & Hogan, 1985).

One of the tasks of differential psychology is related to the identification and measurement of individual differences and their use in predicting outcomes in any area of applied psychology (Hogan & Holland, 2003). Examples of its application include identifying psychological characteristics relevant to academic success or work performance in general or, as in our case, attempting to predict success in scuba diving training and level of performance in the underwater environment. The study of dispositional traits in diving has not been oblivious to the different theoretical trends and developments in applied psychology. At the peak of the factorial theories of personality, typical traits of divers were identified and their correlation with the decision to become a diver and success in diving courses was tested. Despite the fact that the study of dispositional traits was partially abandoned with the prevalence of situationist theories, the interest in this subject has subsequently been recovered and continues today with descriptive, correlational, and experimental methodologies. However, few studies have been carried out to determine the relationship of psychological variables and diver training or to develop procedures to predict underwater adaptation and diving performance (Biersner & Larocco, 1987; Edmonds, 1972; Hogan & Hogan, 1985).

With this purpose, and considering the demands of the undersea environment, the hazardous conditions of diving, the meta-analytic data on individual differences and the results of our previous studies, this paper aims: (a) to determine whether individuals who score higher on General intelligence, Emotional stability, Self-control and Facilitating anxiety tend to show higher performance and adaptation under water, and (b) to ascertain whether divers with lower scores on Emotional sensitivity, Apprehension, Tension and Inhibiting anxiety tend to perform and adapt more positively in the underwater environment.

Method

Participants

The sample consisted of staff from the Spanish Armed Forces and Security Forces of the State who started Elementary Diver courses over the past decade in the Navy Diving Center ($N = 649$) and was composed of adult Spanish men ($M = 28.16$, $SD = 3.06$), with a predominance of single men (61%) and varied educational and professional levels. The percentage of those who completed the diving training was very high, with about 90% becoming qualified for safe scuba diving practice with compressed air and underwater tasks up to a depth of 50 meters. The rest of the sample ($n = 68$) failed to achieve undersea adaptation due to academic, motivational or medical reasons.

Instruments and variables

The psychological evaluation of the applicants' aptitude to perform military diving courses included, among others, the following tests. The general intelligence test (TIG-2; TEA, 1994) assesses general mental ability and core functions of intelligence based on 50 problems proposed by dominoes. This test follows the same principles as the g factor tests and has high reliability ($\alpha = .90$). The sixteen personality factor questionnaire (16PF; Cattell, 1998) is one of the most used tests in Spain for the normal personality assessment in non-clinical practice. Its scales have satisfactory rates of stability and equivalence between parallel forms (Seisdedos, 1992). Using an incidental sample of our study ($n = 250$) based on the availability of the original answer sheets, the values of internal consistency were in a range ($.6 \leq \alpha < .7$) of acceptable magnitude. The Facilitating and Inhibiting Anxiety Questionnaire is a test of 50 items, drawn from Pelechano's work (1975), for assessing anxiety processes in military divers. The content of the scales is related to anxiety components that either facilitate performance through increased autonomic arousal or inhibit it through increased activation and internal concerns. In the same incidental sample of divers, reliability coefficients ($.7 \leq \alpha < .9$) reached a good magnitude.

The independent variables used in this study were of a purely psychological nature. Demographic and professional variables were only analyzed to determine the characteristics of the sample. The basic dependent variable was the Final Average Grade (FAG), constituted by the weighted average of the weekly results obtained during the course in theoretical examinations, physical training and diving exercises. In addition, two dichotomous indicators of underwater adaptation were used: completion or failure to pass the diving training and high or low adaptation to the undersea environment. In the latter case, the lower or higher undersea adaptation level is defined based on the first and third quartiles of the FAG distribution.

Procedure

The methodology for psychological data collection during the first week of the Elementary Diver course was in accordance with the guidelines of the Spanish Armed Forces Psychology Service Regulations. The psychological, demographic and academic variables were collected in a database without personal identification. In this study, a correlational research design with quantitative methodology was used, in order to describe and examine associations of the independent variables with diving performance and underwater adaptation. It was an ex post facto study, the main advantages of which are to enable large-sample studies and external validity.

Data analysis

The relevance of individual differences in predicting underwater performance and adaptation was analyzed with linear and logistic regression techniques, after verifying the basic assumptions of the least squares and maximum likelihood methods, using the SPSS 19.0 program (SPSS, 2010; Tabachnick & Fidell, 1999).

Firstly, the indicators of intellectual capacity, personality factors and the performance criterion (FAG) were used, and simple linear regression estimators were determined. Later, the

capacity to predict the criterion of scuba training performance was analyzed with multiple regressions, specifying a full model and selecting the independent variables that reach significance by means of a stepwise regression procedure. Finally, to verify the prediction of adaptation to the underwater environment, logistic regression and ROC (Receiver Operating Characteristic) curve analyses were employed, with the differentiation in the centroids of sample subgroups being previously ascertained by means of multivariate analysis (Wilks' λ).

Results

The psychological variables assessed in our sample had normal distributions and homogeneity of variances, with the exception of Tension and Inhibitory anxiety. From the bivariate viewpoint, two intellectual indicators and seven personality factors presented significant regression coefficients, confirming the linear association of the intelligence and personality traits with underwater performance. With $df = 579$, a direct relationship was verified in the case of Mental ability (General intelligence, Reasoning), Emotional stability, Emotional control and Facilitating anxiety, and an inverse linear relationship in the case of Emotional sensitivity, Apprehension, Tension and Inhibiting anxiety.

In addition, we estimated the joint contribution of dispositional traits to predict underwater performance with different models. The complete model presented a multiple correlation coefficient ($R = .55$) explaining 30% of the variance of the FAG. The relatively more important psychological variables were Emotional control, Emotional sensitivity, Social boldness, General intelligence, Facilitating anxiety, Emotional stability, Apprehension, Conformity, Vigilance, and Tension. The results of the stepwise regression are summarized in Table 1. This type of regression allowed us to define a model whose coefficient of multiple correlation ($R = .54$) explained the same percentage (30%) of underwater performance variance as the full model. The 11 selected variables contributed to significantly predicting

Table 1
Summary of multiple linear regression analysis of underwater performance (n = 581)

Predictor	Diving performance (FAG) ^a		
	B (SE)	β	t
Emotional sensitivity	-.027 (.006)	-.184	-4.62***
Emotional stability	.016 (.007)	.132	2.46*
Self-control	.034 (.008)	.194	4.30***
General intelligence	.012 (.003)	.139	3.42***
Facilitating anxiety	.019 (.005)	.136	3.44***
Conformity	-.025 (.008)	-.125	-2.96**
Tension	-.042 (.020)	-.106	-2.15*
Vigilance	.018 (.007)	.107	2.58**
Apprehension	-.017 (.007)	-.126	-2.50*
Social boldness	-.010 (.005)	-.094	-2.12*
Reasoning	.020 (.010)	.080	2.02*
R ²		.30	
F		19.98***	

Note: ^a Final Average Grade
* $p < .05$; ** $p < .01$; *** $p < .001$

performance during the scuba diving course having a direct relationship with Emotional stability, Emotional control, General intelligence, Facilitating anxiety, Vigilance, and Reasoning. In the case of Emotional sensitivity, Conformity, Tension, Apprehension, and Social boldness there was an inverse relationship. The resulting model had predictive capacity because the variance explained by the regression equation was 20 times greater than the unexplained variance, as indicated by the results of the ANOVA. The model was not overdimensioned, according to the similarity of the values of the coefficient of determination ($R^2 = .30$, adjusted $R^2 = .28$).

An initial logistic regression analysis, where successful completion or not of the diving course was used as the dependent variable, provided a significant model that predicted the outcome of the course with a important percentage of success (89%), but it was not able to predict the diving students that failed the training course. This result reflects the difficulty of predicting the probability of dichotomous variables when the observations are concentrated in one category (Tabachnick & Fidell, 1999). As a result of the small proportion of failures in the training, the criterion used in a second statistical approach was that of the extreme groups defined as the first and third quartile of applicants' underwater adaptation ($n = 177$ in each case). In this case, the full logistic regression analysis yielded a statistically significant model with appropriate adjustment and predictive validity. The regression coefficients of Intellectual capacity, Emotional stability, Conformity, Social boldness, Emotional sensitivity, Vigilance, Imagination, Apprehension, Emotional control and Facilitating anxiety were significant, according to the magnitude and probability of the Wald contrast. The sensitivity (78.5%) and specificity (83.6%) indices were associated with the correct classification 81.1% of divers with higher and lower adaptation.

Furthermore, a logistic regression procedure was carried out in which the most suitable predictors were selected in successive steps, using the forward method with the likelihood ratio criterion for contrast variables introduced or excluded, obtaining a significant simplified model, $\chi^2(10) = 171.75$, $p = .001$, with appropriate fit and predictive validity, according to the Hosmer

and Lemeshow test, $\chi^2(8) = 6.72$, $p = .567$, and Nagelkerke's pseudo-coefficient of determination ($R_N^2 = .51$). Table 2 specifies the coefficients, contrasts and odds ratios of the selected variables: Emotional stability, Emotional sensitivity, Facilitating anxiety, General intelligence, Emotional control, Apprehension, Vigilance, Conformity, Social boldness, and Imagination. The odds ratios greater or less than 1 were associated with better and worse underwater adaptation, respectively. The obtained sensitivity (79.1%) and specificity (80.2%) indices were associated with a percentage of 79.7% of the correct classification of divers with higher and lower levels of underwater adaptation, the accuracy of predictions being statistically significant, $\chi^2(1) = 124.59$, $p = .001$. Figure 1 shows the ROC curve for the undersea adaptation prediction, analyzing all possible Sensitivity (true positive rate) and 1-Specificity (false positive rate) cutpoints. The value of the area under the curve ($AUC = .87$, $p = .001$), the most commonly used global index of classification accuracy, indicates an excellent predictive capacity.

Discussion

This study proposed the analysis of psychological variables in basic scuba diving courses, in order to determine the relevance of individual differences in adaptation to an extreme and dangerous environment. To this end, we analyzed the results obtained in military diving courses carried out over a ten-year period in the Spanish Navy, studying their validity to predict the level of performance during diving training and their multivariate contribution to the prediction of underwater performance and adaptation.

The results indicate the existence of psychological variables that help to predict performance and adaptation to the extreme diving environment and allow us to anticipate the outcomes of the training of divers and their behavior in the undersea environment. First, it was verified that intellectual capacity and

Table 2 Summary of logistic regression analysis for variables predicting underwater adaptation ($n = 354$)					
Predictor	Underwater adaptation (Q1/Q3 ^a of FAG) ^b				
	B	SE	Wald	OR ^c	95% IC ^d OR
Emotional stability	.192	.052	13.44***	1.21	1.09 - 1.34
Emotional sensitivity	-.156	.047	11.01***	0.86	0.78 - 0.94
Facilitating anxiety	.171	.043	16.23***	1.19	1.09 - 1.29
General intelligence	.082	.026	10.20***	1.08	1.03 - 1.14
Self-control	.189	.062	9.21**	1.21	1.07 - 1.37
Apprehension	-.165	.056	8.82**	0.85	0.76 - 0.95
Vigilance	.161	.057	7.92**	1.18	1.05 - 1.32
Conformity	-.164	.068	5.834*	0.85	0.74 - 0.97
Social boldness	-.081	.038	4.51*	0.92	0.86 - 0.99
Imagination	.096	.048	3.97*	1.10	1.00 - 1.21
Nagelkerke's R^2	.51				
Model χ^2 (df)	171.75(10)***				

Note: ^aFirst and third quartiles. ^bFinal Average Grade. ^cOdds ratio. ^dInterval confidence
* $p < .05$; ** $p < .01$; *** $p < .001$

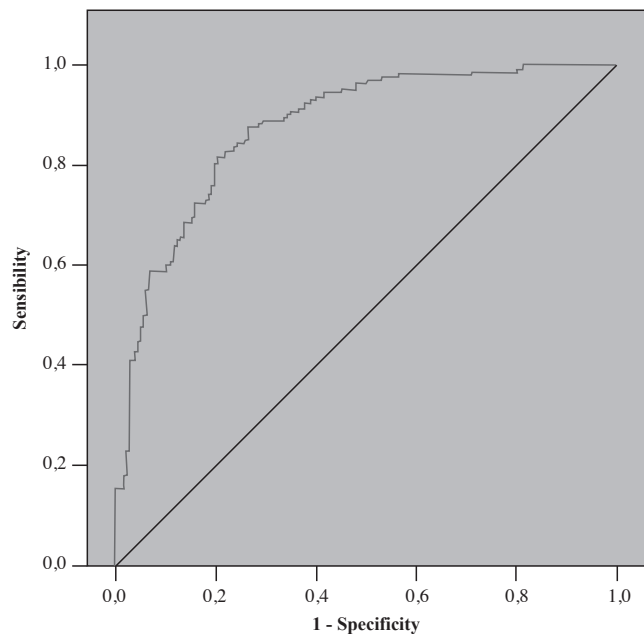


Figure 1. Empirical ROC curve of psychological traits on underwater adaptation

personality traits contribute univariately to the prediction of the level of performance in scuba diving. Subsequently, we analyzed the multivariate contribution of dispositional traits. Regarding underwater performance, the results obtained by means of multiple regression confirm the predictive power of Intellectual capacity, Reasoning, Emotional stability, Emotional control and Facilitating anxiety with the positive sign of their coefficients and, in addition, the negative sign of Emotional sensitivity, Apprehension and Tension. Stepwise regression enabled us to define a model whose coefficient of multiple correlation ($R = .54$) reached statistical significance and explained the same percentage (30%) of variance in the performance criterion as the full model. The resulting model is significantly predictive, not overdimensioned, and validated. Regarding underwater adaptation, the most important predictors are Emotional stability, Emotional hardness, Facilitating anxiety, Intellectual capacity, Emotional control, Security, and Vigilance. With a logistic stepwise regression procedure, we obtained a significant model, having a pseudo-coefficient of determination ($R_N^2 = .51$) supporting the fit of the data. This model is associated with an 87% success rate in the classification of divers with higher and lower levels of underwater adaptation, with a useful ROC curve for the evaluation of psychological fitness to dive.

Our results are broadly consistent with the first longitudinal studies on the validity of psychological tests on samples of Spanish divers and contemporary studies with English divers (Colodro, 1994; Moray, Ross, & Synodinos, 1979). In data obtained in the Spanish Navy, intellectual and personality variables were found to be significantly correlated with underwater performance, explaining 42% of the total variance ($R = .65, p < .001$) with 13 variables (Colodro, 1994). From a multidimensional perspective, 30% of the variance of the final result obtained in diving courses conducted in the Australian Navy ($R = .55, p < .05$) was explained with 48 variables (medical, psychological and physical). Intelligence, emotional maturity, self-reliance, practicality, motivation, swimming capability, physical fitness and respiratory function were related to the successful completion of the training (Edmonds, 1972). Another variant of multidimensional studies jointly analyzed the contribution of physical and psychological variables in predicting performance during the diving training programs of the U.S. Navy ($R = .66, p < .01$). It was found that, with physical variables, 28% of the variance of performance in the diving course could be explained, with the figure reaching 43% when psychological variables were added (Hogan & Hogan, 1985).

The data from this paper improve the results of the studies cited in the previous paragraphs. Similar percentages of the explained variance of underwater performance are achieved with a smaller number of variables and using exclusively psychological traits. Moreover, the results of recent research on underwater and hyperbaric adaptation, which have proven the effectiveness of the measure of anxiety in predicting the reaction of panic in diving and the occurrence of dysbaric accidents, are taken into consideration (Morgan et al., 2004; Rieben & Miller, 2000; Tetlow, 2006). The results also agree with the idea, accepted among the diving community and professionals who care for divers, that psychological characteristics play a decisive role in successful adaptation to the undersea environment (Bachrach & Egstrom, 1987; Biersner, 1984; Biersner & Larocco, 1987). Furthermore, our results are consistent with studies using historical samples of Spanish divers, demonstrating the ability to discriminate between

subgroups with different levels of adaptation and performance during diving training based on the individual resources necessary to meet the demands of the underwater and marine environment (Colodro, Garcés de los Fayos, & Velandrino, 2012). However, unlike the hypotheses generated from the results of previous studies performed in the Spanish Navy, neither the usefulness of the Conformity trait in predicting undersea performance nor the significance of Reasoning or Tension traits in predicting underwater adaptation could be verified.

The results of the multiple and logistic regression analyses support the conclusion that individual differences can be used to predict adaptation and work performance under water, in accordance with current theoretical models about individual differences and performance. Regarding intelligence (Gottfredson, 2002; Ree et al., 1994; Schmidt & Hunter, 2004), the importance of the facets of problem solving and adaptability is emphasized. A higher intellectual capacity enables a better understanding of the environment and also favors the ability to apply the available resources to achieve a suitable level of performance and adaptation to new situations. Furthermore, the measure of intellectual capacity is an appropriate technique for identifying individuals who can adapt to a changing and unpredictable environment such as the underwater one. With regards to personality (Barrick et al., 2001; Hogan, 2005; Mount & Barrick, 1995; Salgado, Viswesvaran, & Ones, 2001), in this study, we found that the traits associated with the dimensions of adaptability and emotional stability may be useful for predicting diving performance and adaptation to the environmental and operational conditions of diving. Good performance and adaptation requires coping with stressful situations, applying skills and resources at appropriate times, and reacting appropriately to emergency situations.

For the reasons exposed above, the differential approximation of the dispositional traits of intelligence and personality may be suitable for evaluating psychological fitness to dive, as its joint usefulness has been verified in predicting (a) the availability of the necessary resources to work under water, (b) self-control in an extreme, changing and uncertain field, and (c) the functional response to the demands of the underwater environment. The predictors of underwater adaptation and performance in diving are integrated into the dimensions of Neuroticism, Conscientiousness and Openness to experience of the Five Factor model (Costa & McCrae, 1992). Furthermore, the criterion of diving behavior is included in dimensions of the general performance model, such as task performance and adaptive performance (Campbell et al., 1993; Pulakos et al., 2000).

Although the Spanish model for assessing fitness to dive refers to physical, psychological, and physiological evaluations, in this study, exclusively the psychological variables were analyzed in order to determine their specific contribution to performance and adaptation to this extreme and hostile environment. Furthermore, a convenience sample was used, consisting of divers who have participated in basic scuba diving courses over a ten-year period in the Spanish Navy. However, the size of this sample ensures its statistical power, and its previous homogeneity highlights the importance of the regression coefficients on underwater performance and adaptation. These limitations in the variables and sampling encourage us to consider the advisability of using new measuring instruments that share the model of intelligence, personality and anxiety and to analyze different samples of

divers in future research, in order to confirm the importance of dispositional traits in explaining performance and adaptation in the underwater environment.

Since diving is an activity in which it is often necessary to solve problems and incidents, to master working techniques in a non-natural setting, to cope with stressful diving situations, and to implement self-control and manage anxiety in a non-habitual environment, it may be useful to take advantage of the

validity of individual differences in dispositional traits in order to estimate performance in scuba diving and predict adaptability to underwater environments.

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